Indicators

1) A student put 10 ml of dilute nitric acid in a boiling tube with five drops of universal indicator. Sodium hydroxide of the same concentration was then added. The following observations were recorded.

Amount of sodium hydroxide added (ml)	Colour of solution
0	red
10	green
20	purple

Discuss the reaction occurring as sodium hydroxide is added to the nitric acid. In your answer you should:

- explain the relationship between the colours observed and the pH of the solution
- explain which ions cause the different colours of the solution
- write a word equation for the reaction AND a balanced symbol equation for the reaction.

2) a) State the colour seen if red litmus and blue litmus are added to separate samples of the following solutions.

Solution	Red litmus added	Blue litmus added
Water		
Sodium hydroxide		
Hydrochloric acid		

b) Write down the pH number that best represents the pH of each of the following: pure water, sodium hydroxide, hydrochloric acid

3) a) The pH values of three substances are given below:

Hydrochloric acid	pH = 1
Potassium carbonate solution	pH = 9
Sodium hydroxide solution	pH = 14

When Universal Indicator solution is added to each of the substances listed above , what colour would result?

b) Potassium carbonate solution is added slowly to the hydrochloric acid (without indicator) in a beaker until no further change is seen.

i) Describe what you would see happening when potassium carbonate is added to the acid.

ii) Write a balanced chemical equation for the reaction between potassium carbonate and hydrochloric acid.

c) In another experiment, sodium hydroxide solution is added **slowly** to the hydrochloric acid to which **Universal Indicator solution** has been added. Describe how the colour of the Universal Indicator solution changes as the sodium hydroxide solution is added. Discuss how the **colour** changes relate to the substances present in the solution. Use the substances from the key list: water, sodium chloride, sodium hydroxide, hydrochloric acid

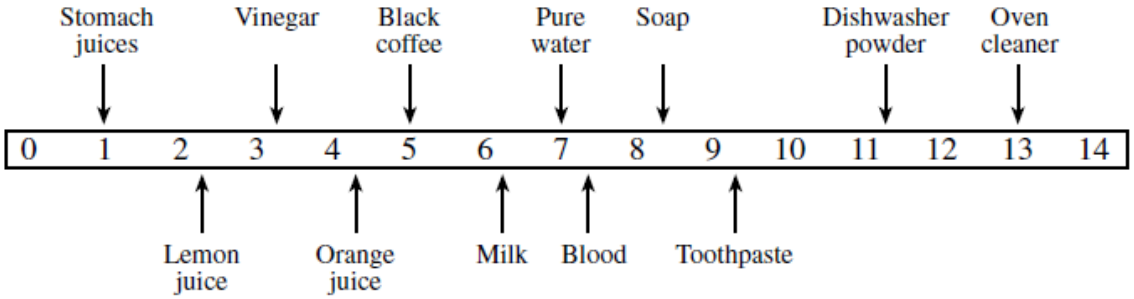
4) a) James carried out an investigation to see how many colours he could make with universal indicator. He started with 5 mL of dilute hydrochloric acid in a boiling tube and added 5 drops of universal indicator. The solution turned red. James then added dilute sodium hydroxide to the boiling tube, a drop at a time, until the solution turned purple.

i) James obtained three more colours as he added the sodium hydroxide to the acid. These colours were green, blue and yellow. Write the colours in the correct order as they appeared.

ii) Which colour on the chart corresponds to a pH of 1–2?
iii) Discuss what effect adding the sodium hydroxide has on the pH of the solution in the boiling tube.

5) a) write down the colour of the following substance with **i)** Universal Indicator and **ii)** litmus paper

Hydrochloric acid
Calcium oxide



b) i) Name the most strongly alkaline substance shown above.

ii) Which fruit juice is more acidic than vinegar?

iii) Bacteria can turn sugar in your mouth to acid that attacks teeth. Explain why toothpaste has such a high pH